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Ray-Tracer Project Report

Goals: With this project, I wanted to make a scalable basis for creating ray-traced images using Web-GL in order to project the desired result in a preview.

User Guide:

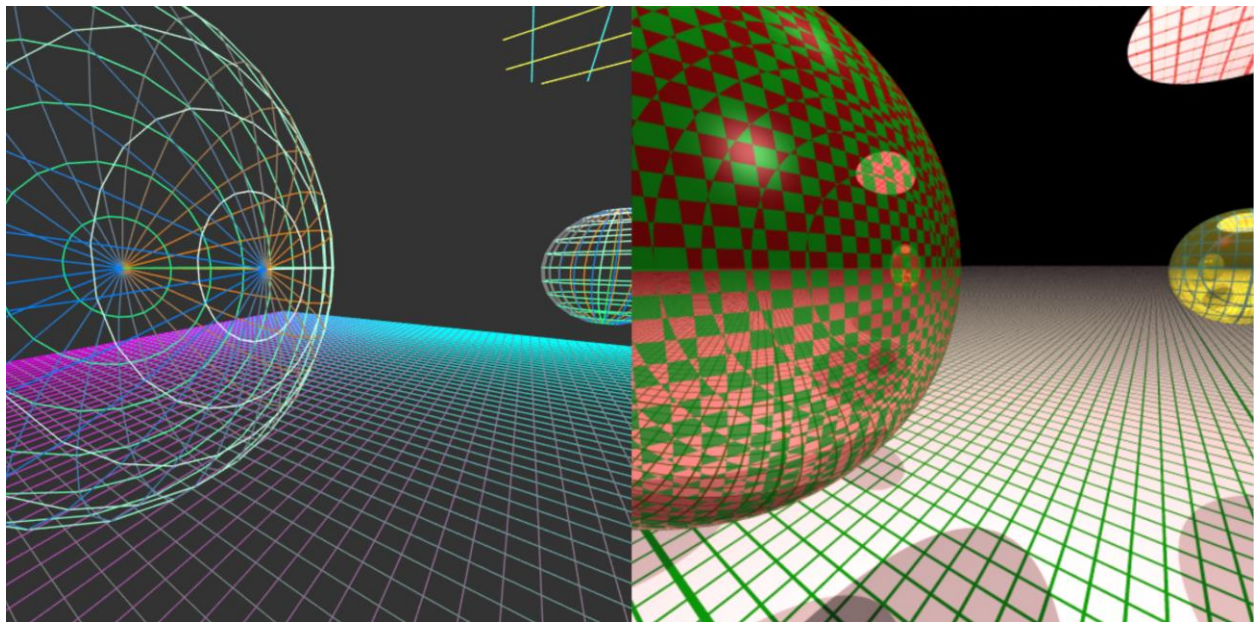
In order to navigate the scene, users can use the w/a/s/d keys as well as the q/e keys to strafe. Clicking and dragging on either window will rotate the camera accordingly.

From the buttons below the canvas, users can access one of 4 scenes I have created.

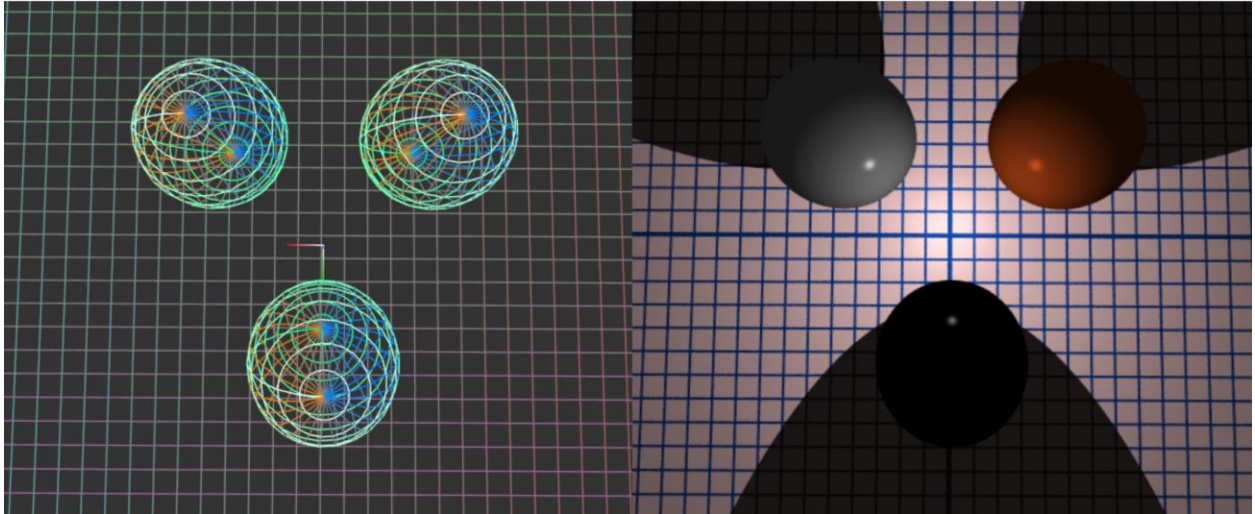
Furthermore, there are a number of customizable options such as the dimensions of the Super Sampling Anti-Aliasing (AA) as well as the jitter option for AA, the depth of the recursion used to model reflections up to 16 and an on/off switch for each light in every available scene.

Finally, some tracing options can make the process rather long. Make sure to open the console to get feedback on the progress of the rendering.

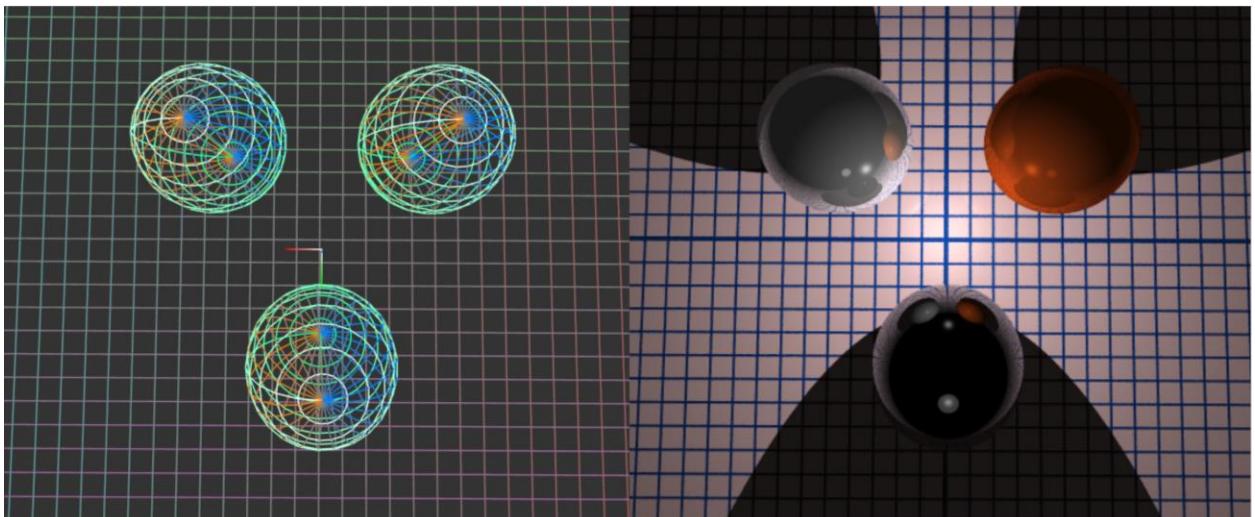
Results:



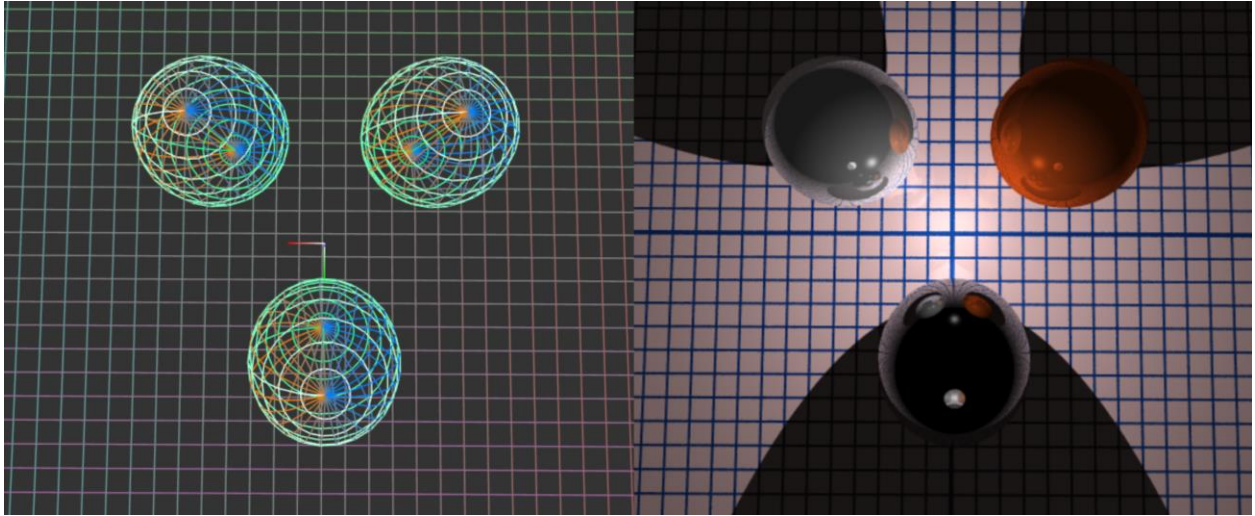
This picture from scene 1, highlights the procedural materials, both the 3D checker board (left) the 3D grid mapped to a sphere (right). We can also see that the preview matches exactly with the resulting picture with the exception of lighting effect. (512x512 pixels, 4X SSAA, no jitter).



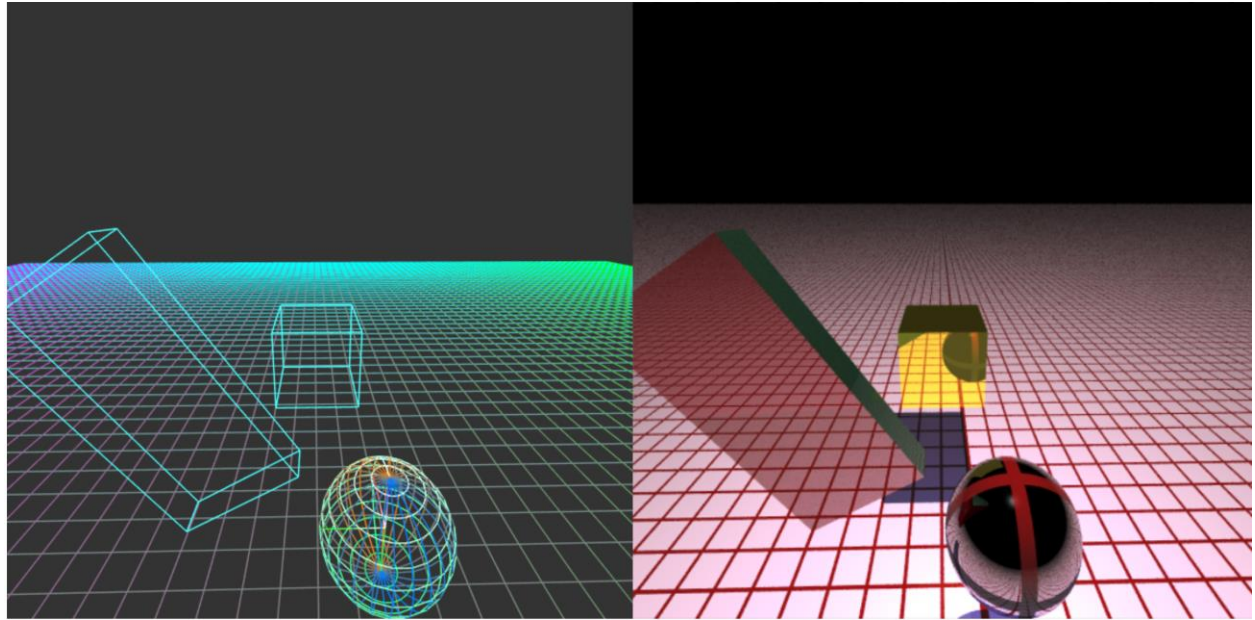
This picture is taken from scene 2 where we can clearly see realistically carved shadows and Phong lighting. At recursion depth 0, the mirror ball (bottom) as well as its shiny counterparts exhibit no reflections (512x512 pixels, 3X SSAA, jittered).



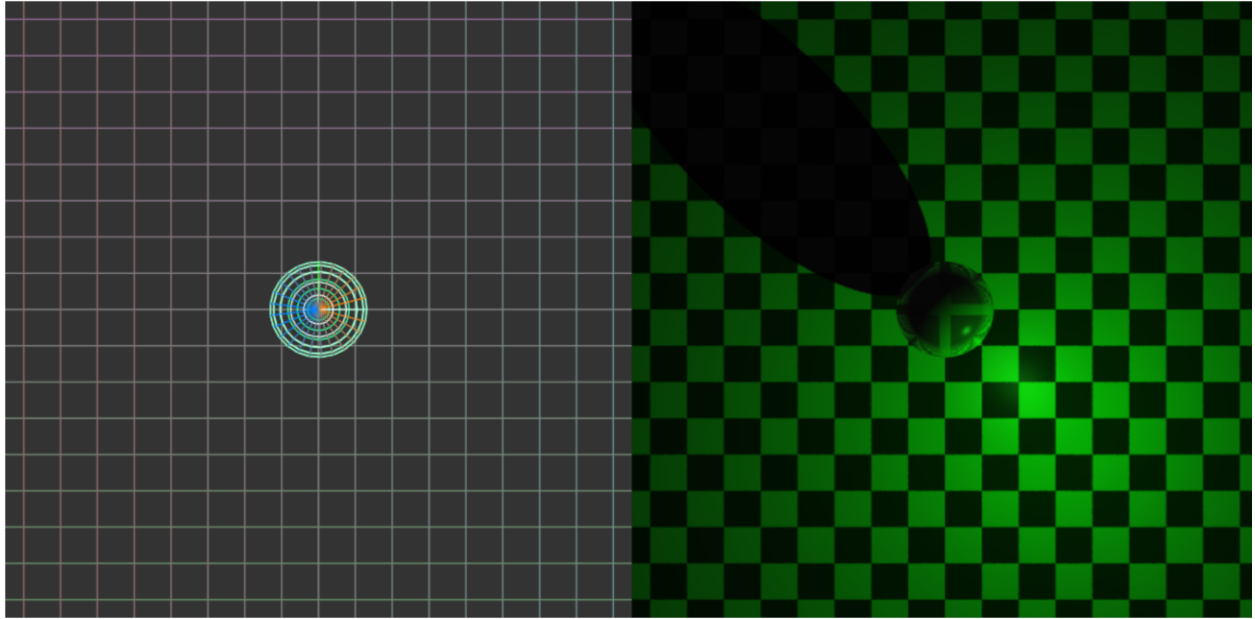
The same picture as above taken at recursion depth 1, we can see each ball reflected in its neighbors. Notably, the mirror ball is no longer only pitch black (512x512 pixels, 3X SSAA, jittered).



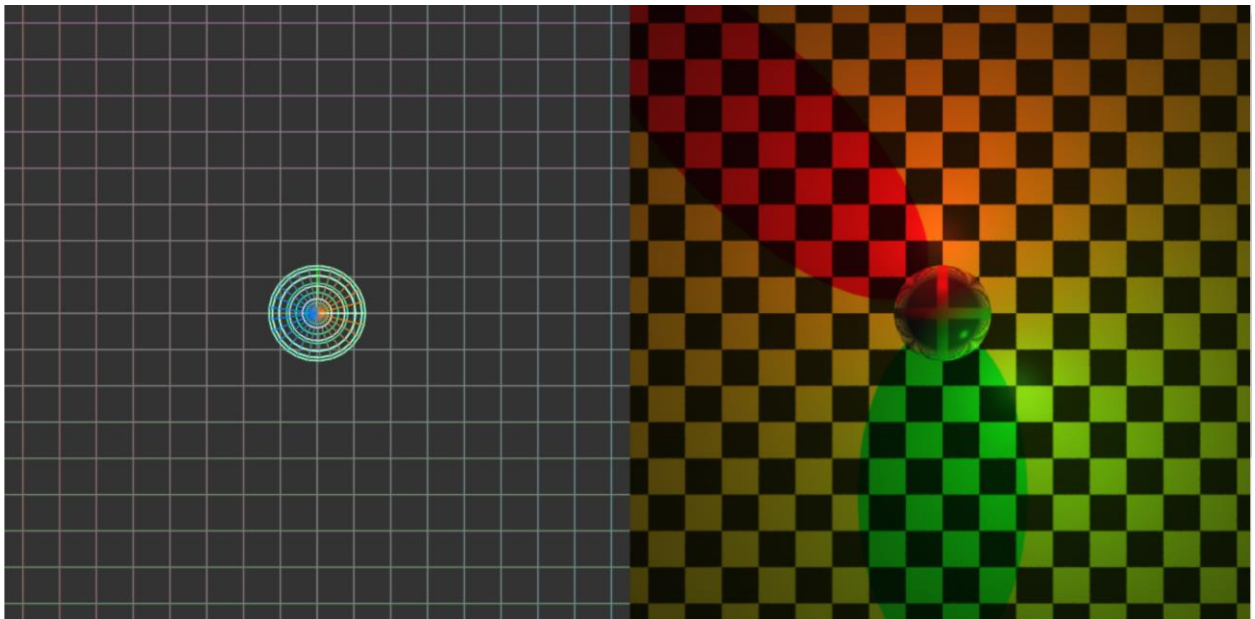
At depth reflection 2, we can see an inner reflection in each of the initial reflections in the above image (512x512 pixels, 3X SSAA, jittered).



This picture, taken from scene 3, showcases a new shape, a cube which is also shown distorted and rotated. (512x512 pixels, 3X SSAA, jittered).

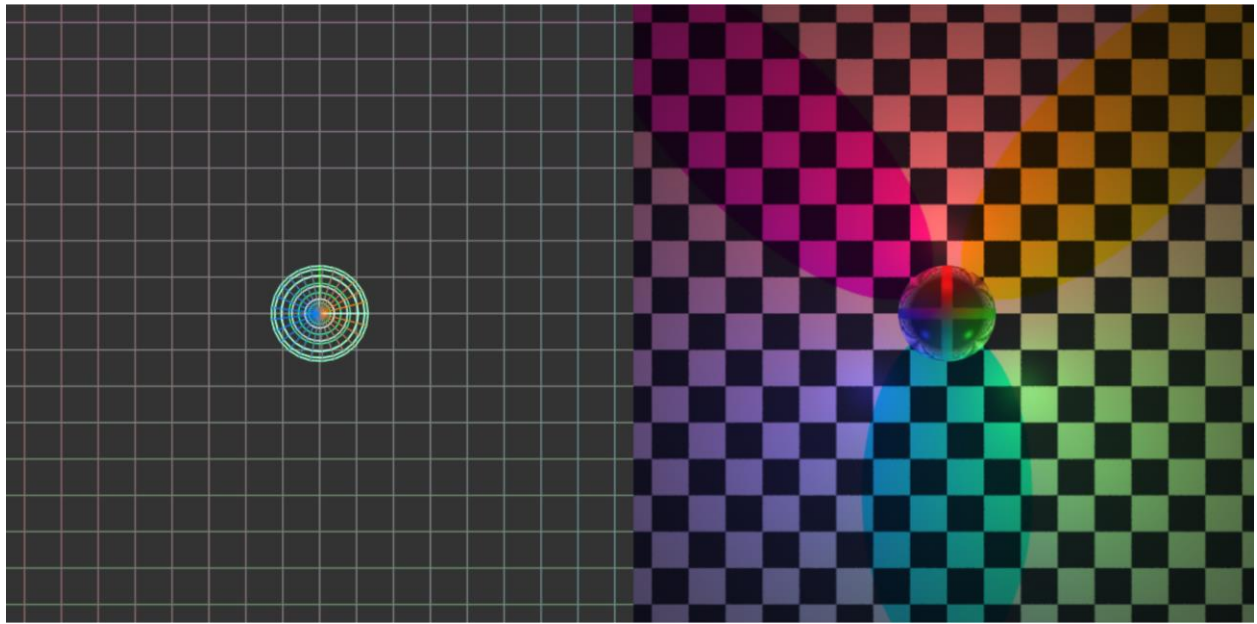


This picture, from scene 4, showcases the combination of colored lights and shadows. Here we can see a simple sphere with a single colored light. (512x512 pixels, 3X SSAA, jittered).



Now with the second light turned on... (512x512 pixels, 3X SSAA, jittered).

And finally, with all three lights turned on! Notice how the lights merge to form secondary colors which are opposite from their complement light (i.e. in their shadow). (512x512 pixels, 3X SSAA, jittered).



Optional Materials:

- 3D Checker material on a Sphere, a Plane and a Cube (the distorted one in scene 3, it doesn't look as good on it)
- 3D grid material on spheres in scenes 1, 3 and 4
- The disk shape present in scenes 1 and 2
- The cube shape present in scene 3